

Segmental Culvert Liner Installation



Produced by
The Utah Department of
Transportation
And
Utah State University

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Table of Contents

Section 1: Which culverts can still be
restored by lining?
Page 3

Section 2: When is it more cost-
effective to line a culvert rather than
dig and replace it?
Page 6

Section 3: What is required to install
a segmental liner?
Page 8

Section 4: Installing a segmental
liner
Page 9

Section 5: Fact sheets
Page 23

SECTION 1
Which culverts can still be restored
by lining?



Deformed circular culverts, shown above, can still be lined.

Flattened sections lack strength and can lead to reverse curvature failures as seen below.





Corrosion in pipe inverts and/or poor leaky joints in new culverts can cause “piping” failures as seen here.



Deteriorating culverts such as the picture below can still be lined. The grout pumped between the culvert and the liner can be used to fill voids similar to these.



Piping and the loss of soil materials from around a culvert is cumulative.



SECTION 2

**When is it more cost-effective to
line a culvert rather than dig and
replace it?**

When the Average Daily Traffic is
1000 vehicles or more



When the maximum cover over a
culvert is more than 4 feet



When the detour route for the work area is greater than 20 minutes



Conventional dig and replace
requires costly pavement repairs
and complex traffic control.

SECTION 3

What is required to install a segmental liner?

Liner Pipe
Gasket Seals
Ready-mix for bulkhead
Sealant as required for
standing/running water
Vent Tubes (18-24" long)
PVC Tubes to pump grout
PVC Glue
End Caps
Spray Lubricant (vegetable spray)
20-30' Chain
Chain with Binders
Chain Come-Along
20" long 2x4 wood blocks
Backhoe/Trackhoe
Pry bar
Metal banding material with clamps
Radios
Plywood for pushing liner
Saw (if nose cone required)
Shovels
Wheelbarrow
Trowel
Crew Required
4 laborers
1 machine operator

SECTION 4

Installing a Segmental Liner

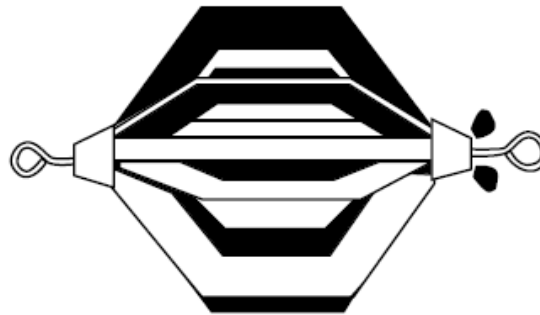
Step 1: Clean and flush culvert using available equipment



Step 2: Check for distortions in the
culvert

A mandrel can be used to make sure
the liner can be installed without
being forced.

***Example of a Mandrel
Used in Deflection Testing***



If the mandrel can not be slid
through the culvert without catching
on distortions, a smaller liner may
be necessary.

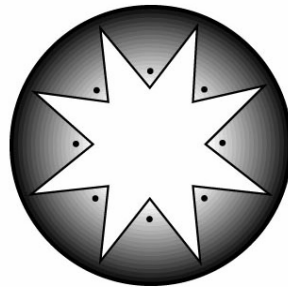
A culvert inspection camera can also be used to determine any conditions inside the culvert that may require special attention.



If the existing culvert is misaligned, partially collapsed or has faulted joints, create a nose cone by cutting the male end of the pipe into 8 dove tails with a saw.



Drill holes into each dove tail, about 1 inch from each tip. Connect a wire between opposite holes and tighten to draw the dove tails together.



End View

Step 3: Place 1st liner segment,
preferably at the outlet



Step 4: Use equipment to push/pull
liner into the culvert



Step 5: Line up the male end of the next liner section with the female end of the first section



Step 6: Clean ends of the liner with a rag.



Place a gasket on the male end of the liner.



Apply lubricant evenly to both ends of the liner.



Use Spray On Gasket Lubricant or Vegetable Spray.



Step 7: Double wrap chains four feet from the ends of the liner and tighten with binders.



Step 8: Attach come-alongs on each side, 180 degrees apart. Use closed hooks on the come-alongs.



Use come-alongs (chains NOT cables) to safely apply force to both sides of the liner. Listen for 2 distinct popping sounds as they “snap together”



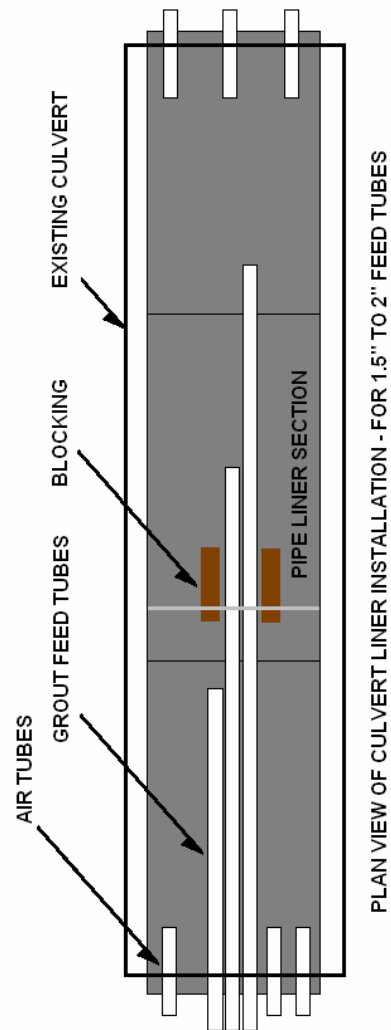
Step 9: Band the grout feed tubes to the liner with two adjacent 2x4s
Label the feed tubes according to length.



Step 10: Insert the joined liners into the culvert. Repeat steps 5-10 until culvert is fully lined.



THIS IS ONLY AN EXAMPLE, DESIGNS
MAY VARY



PLAN VIEW OF CULVERT LINER INSTALLATION - FOR 1.5" TO 2" FEED TUBES

Step 11: Seal the culvert ends with concrete mix at least 8" thick and insert air tubes on top and sides



Step 12: Grout the space between the culvert and the liner as soon as practicable after the bulkhead is set up.



Step 13: Apply any special end treatments to the inlet/outlet if necessary.



Contact your Region Hydraulic Engineer for any further questions on culverts or culvert liner installations.

UDOT Central Hydraulics maintains contact information on their website at www.dot.state.ut.us
Under Inside UDOT
-Project Development
-Hydraulics

**Special thanks for all your hard
work**

Region 4
Bob Nebeker

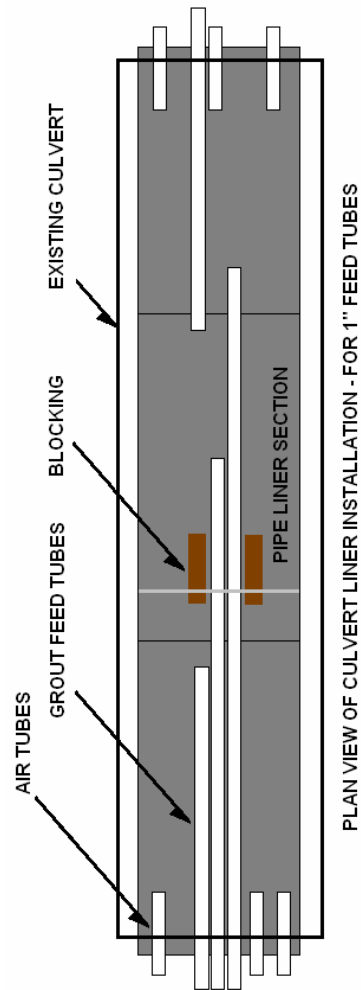
The Junction Crew 4326
Corwin Christensen
Brent Jessen
Glen Allen
Marcus Gleave

The Gunnison Crew 4328
Glade Ludvigson
Boyce Mulder
Robbie Hatfield

The Mt Pleasant Crew 4334
Kevin Jensen
Chad Beck
Scott Justesen
Thomas Davis

Region 1
Val Stoker
Kelly Andrew
Kyle Hess

SECTION 5 Fact Sheets
THIS IS ONLY AN EXAMPLE, DESIGNS
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Controlled Low Strength Material (CLSM) Facts

CLSM (aka Flowable Fill) is used for backfill material, particularly for work around pipes.

CLSM is self leveling and does not require vibrating or tamping to compact the material.

A typical slump for CLSM may be 8-10 inches.

Typically, a 28th day unconfined compressive strength of 100 psi is specified for excavatable fill.

Buoyancy is a common concern with CLSM.

CLSM unit weight varies from 70 to 145 pcf.
(Compare water density of 62.4 pcf)

Typical CLSM consists of hydraulic cement, pozzolans (fly ash), sand and water.

Fly ash hardens rapidly, is frost susceptible and may increase the ultimate strengths beyond the 28-day strength.

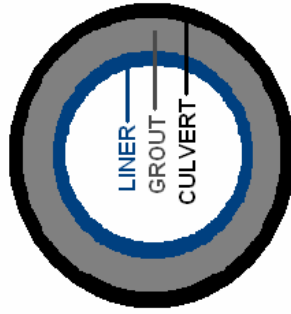
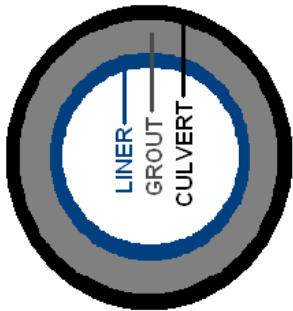
Water reducing agents NOT typically used in CLSM.

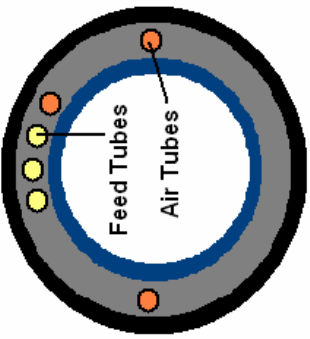
Foaming agents can be used in high fly ash content CLSM to significantly decrease density (i.e. 20 pcf.)

When removing grout, a 250 psi strength will strain a backhoe and a 50 psi strength can be carved out with a shovel.

Example Mix: 25# cement, 400# flyash, 30 gallons water, 1870# sand and 1270# aggregate (3/8" minus)

Liner and Culvert Sizes			
Existing Culvert Inner Diameter Sizes	Liner Outer Diameter Sizes	Space Between Liner and Culvert	
24	20	4	
27	22	5	
30	24	6	
36	32	4	
42	36	6	
48	42	6	
54	48	6	
60	54	6	
72	63	9	
84	63	21	
*THIS IS ONLY AN EXAMPLE. LINER SIZES MAY NEED TO BE ADJUSTED DEPENDING ON EXISTING CONDITION OF THE CULVERT.			



Grout Feed Tubes			
Total Length to be Lined	# Feed Tubes	For Clear Grout Space $\geq 4"$ Use 1.5" to 2" Feed Tubes	
50	1	For Clear Grout Space between 2" and 4" Use 1" Feed Tubes and Allow Grout Access at both the Inlet and the Outlet	
75	2		
100	2		
125	3		
150	3		
175	4		
200	4		
225	4		
*PLACE 3 AIR TUBES AT THE TOP AND SIDES OF THE LINER			